



Climate Change Adaptation: U.S. Navy Actions in the Face of Uncertainty



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November 2010**

| Report Documentation Page | | | | Form Approved OMB No. 0704-0188 | |
|--|------------------------------------|-------------------------------------|---|---|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. | | | | | |
| 1. REPORT DATE NOV 2010 | | 2. REPORT TYPE | | 3. DATES COVERED 00-00-2010 to 00-00-2010 | |
| 4. TITLE AND SUBTITLE Climate Change Adaptation: U.S. Navy Actions in the Face of Uncertainty | | | | 5a. CONTRACT NUMBER | |
| | | | | 5b. GRANT NUMBER | |
| | | | | 5c. PROGRAM ELEMENT NUMBER | |
| 6. AUTHOR(S) | | | | 5d. PROJECT NUMBER | |
| | | | | 5e. TASK NUMBER | |
| | | | | 5f. WORK UNIT NUMBER | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Chief of Naval Operations, Task Force Climate Change, Washington, DC, 20350-1200 | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) | |
| | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited | | | | | |
| 13. SUPPLEMENTARY NOTES Presented at the 15th Annual Partners in Environmental Technology Technical Symposium & Workshop, 30 Nov ? 2 Dec 2010, Washington, DC. Sponsored by SERDP and ESTCP | | | | | |
| 14. ABSTRACT | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT Same as Report (SAR) | 18. NUMBER OF PAGES 11 | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT unclassified | b. ABSTRACT unclassified | c. THIS PAGE unclassified | | | |



Drivers

Navy

Defense

National



Executive Order 13514

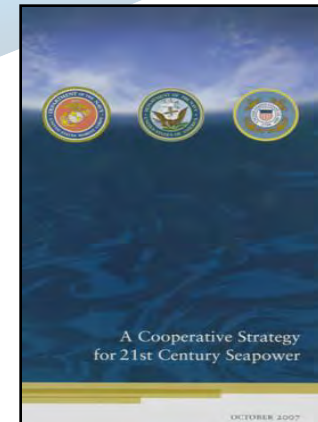
***“Federal Agencies will reduce ,
monitor, track, & report
GHG emissions”***



2010 QDR

***“Climate change, energy security, and
economic security are inextricably
linked”***

***“DOD will work to foster efforts to
assess, adapt to, and mitigate the
impacts of climate change”***



Maritime Strategy
***“Climate change is gradually
opening up the waters of the
Arctic”***

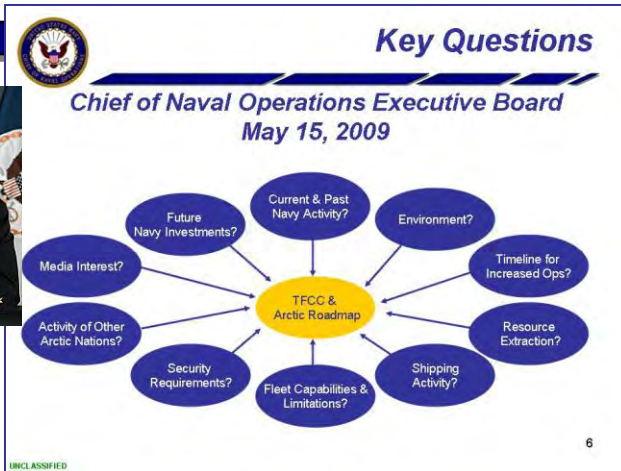
***“These opportunities offer
potential for growth, they are
potential sources of competition
for access and natural resources”***



Task Force Climate Change

Establishment

Chief of Naval Operations
Executive Board on May 15, 2009



Composition

Navy, NOAA, USCG in core group with
Joint, interagency, international support



Charter

Global climate change impacts with near term Arctic focus

Science-based approach, cooperative partnerships, risk assessments



Navy Outreach

INTERAGENCY



NATIONAL



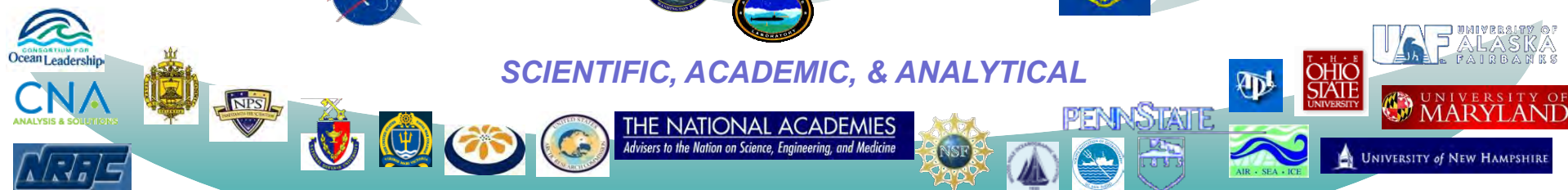
DOD



INTERNATIONAL



SCIENTIFIC, ACADEMIC, & ANALYTICAL



Engaged nearly 450 individuals from over 125 organizations

UNCLASSIFIED



Challenges & Opportunities

Challenges

- Increasing Arctic maritime activity
- Water & resource scarcity
- Sea level rise impact on installations



Opportunities

- Cooperative partnerships
- Energy security initiatives
- Infrastructure recapitalization



Wild-cards

- Abrupt climate change
- Geoengineering
- Dunning-Kruger effect





Adaptive Management



Navy Arctic Roadmap

Phase 1 (FY10)

- Fleet readiness assessment, external studies, strategic implementation plan
- Advocate for UNCLOS^{***}
- Monitor Polar SATCOM Program^{***}
- Arctic TTX & LOE
- POM-12 investments for air-ocean-ice numerical prediction
- Cooperative Navy-NOAA Bering Strait Hydrographic Survey

Phase 2 (FY11-12)

- POM-14 CBA, NSP, & SPPs address the Arctic
- Formalize expanded / new cooperative partnerships
- Arctic SAREX, Arctic Edge, Northern Edge NANOOK^{***}
- ICEX-11
- Environmental assessments
- Support National Ocean Policy / Marine Spatial Planning Implementation For Arctic^{***}
- Interagency partnership for air-ocean-ice numerical prediction

Phase 3 (FY13-14)

- Execute POM-14
- Implement expanded / new cooperative partnerships
- Arctic UUV operations
- Update roadmap ICW QDR
- ICEX-13

Navy recognized as a valued joint, interagency, & international partner in the Arctic

^{***} Indicates recurring action



Climate Change Roadmap

Phase 1 (FY10)

- Climate adaptation assessments, studies
- GHG Tracking & Reporting^{***}
- Continue Arctic roadmap execution^{***}
- Support White House Interagency Adaptation Task Force^{***}
- Research & development for air-ocean-ice observation & prediction^{***}
- Naval Studies Board climate change study

Phase 2 (FY11-12)

- POM-14 CBA, NSP, SPPs address climate change adaptation
- Formalize / new cooperative adaptation partnerships
- Climate change considered in Fleet training, operations, & planning^{***}
- Sponsor climate symposia & conferences^{***}
- Formalize interagency partnership for air-ocean-ice observation & prediction
- Complete sea level rise studies

Phase 3 (FY13-14)

- Execute POM-14
- Implement new cooperative adaptation partnerships
- Implement climate change adaptation study recommendations
- Climate science & security implications included in formal Navy education
- Climate change TTX's & wargames^{***}
- Update roadmap ICW QDR

Navy is fully mission-capable through changing climatic conditions

UNCLASSIFIED

^{***} Indicates recurring action

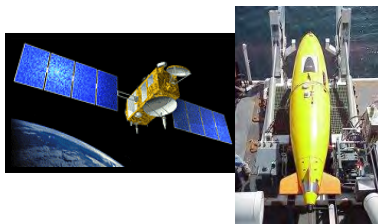
An iterative approach – NOT fire and forget

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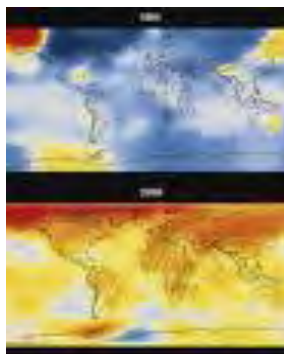


An Adaptation Methodology

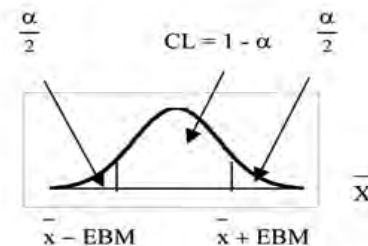
Climate Change
Observations



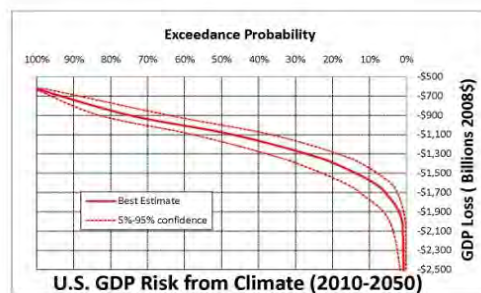
Climate Change
Projections



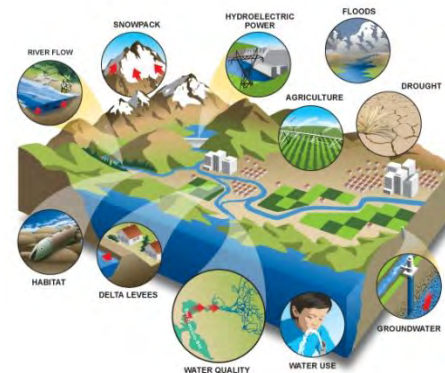
Uncertainty
Quantification



Adaptive
Management



Risk Assessment



Impact
Assessment

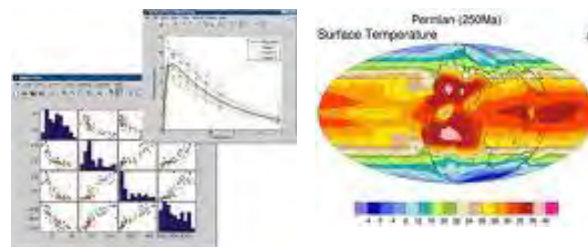
Assessing & Managing Climate Security Risk



Improving Climate Predictions

Earth System Prediction Capability

Recapitalize aging suite of global atmospheric models



Implement interagency collaboration

Revolutionary advancement National predictive architecture

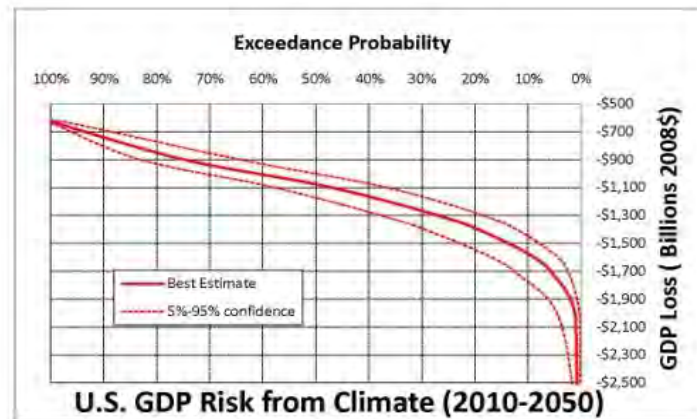


National Imperative – National Approach – National Academies Study



Impact & Risk Assessments

U.S. Water Resource Example



"Assessing the Risk of Near-term Risk of Climate Uncertainty: Interdependencies Among the U.S. States"
Sandia National Labs, 2010

Maritime Security Concerns

TC Forecasts

Sea Level rise

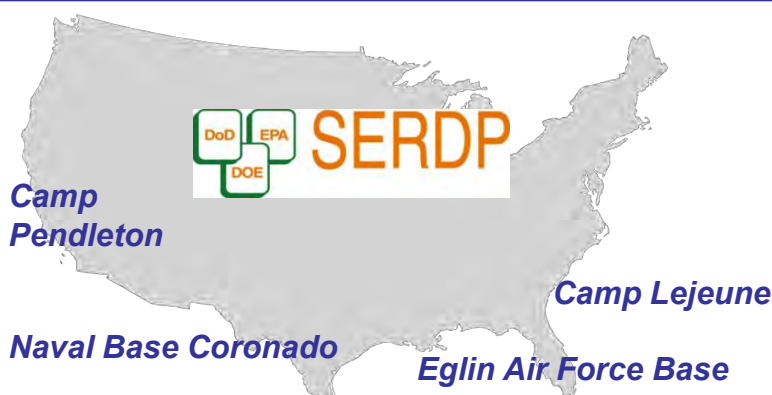
GHG Monitoring



Extreme Weather,
Floods, Droughts

Arctic

National Security



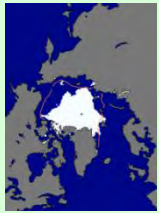
Invest in resilience - but NOT ahead of need



Navy Initiatives

Task Force Climate Change

Observation & Prediction



Next Generation
Air-ocean-ice
numerical prediction



Cooperative
Oceanographic
Surveys



Remote sensing



Environmental
Impact
Assessments



Adaptation

Arctic &
Climate Change
Roadmaps



Sea level rise
impact
modeling



Water resource
management

Arctic civil
relocation
& erosion
control



Arctic fleet
training

Task Force Energy

Energy Efficiency

Smart Grid



Net Zero
Installations



Metering &
Auditing



Incentivized
Conservation



New
Construction
& Renovation



Training &
Awareness



Smart Voyage
Planning, &
Efficient Aircraft &
Ship Systems

Alternative Energy



Portable Power



Biofuels



Renewable power



Alternative Fuel Vehicles

**Technology and Research to Understand,
Predict and Adapt to Climate Change**

**Assure Mobility + Expand Tactical Reach
+ Lighten the Load = Combat Capability**

Reduce the Navy Carbon Footprint

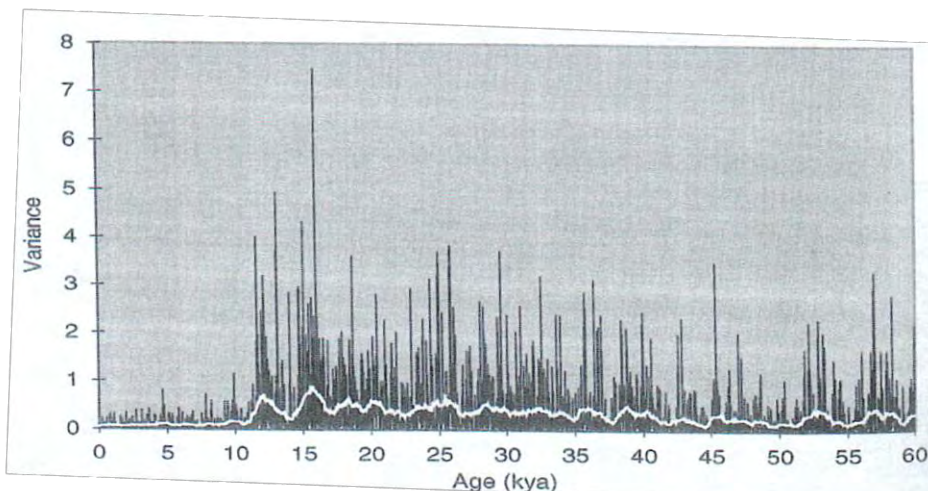


A final thought ...



CLIMATE CHANGE IN PREHISTORY

The End of the Reign of Chaos



... true, if this



... or else this

